WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005OK40B

Title: Optimal Selection of Management Practices, Policies, and Technological Alternatives for Phosphorus Abatement: Using GIS and Economic Methodology to Model a Watershed

Project Type: Research

Focus Categories: Economics, Management and Planning, Water Quality

Keywords: watershed, GIS, poultry litter, phosphorus, hydrology, best management practices

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Abstract

The Eucha-Spavinaw watershed, shared by the states of Oklahoma and Arkansas, has been troubled by water and soil pollution for a number of years. In particular, lake eutrophication has been blamed on high phosphorus loading in the watershed. This high phosphorus loading is attributed to excessive land application of litter produced by the intensive poultry production in the area. Eutrophication has made the water undrinkable

without expensive treatment by municipal water treatment plants. The recreational value of the lakes has also diminished.

This study will evaluate the efficiency of a set of policies designed to remedy phosphorus pollution problems in the Eucha-Spavinaw watershed in Eastern Oklahoma and Western Arkansas. Specific objectives of the study are to:

1. Determine the economic viability and best location for poultry litter-to-energy facilities.
2. Determine the most economically effective set of poultry litter management practices and/or STP regulations that meet specified limits on soluble phosphorus runoff.
3. Determine the most efficient pattern of litter transportation for use within the watershed and for removal of excess litter from the watershed.

A basin-level mathematical programming model will be used to simultaneously determine: a) the optimal location of processing facilities for and the quantity of poultry litter to be converted to energy, b) the quantity of litter to be transported from poultry houses to locations within and out of the watershed, and c) the best management practices for applying poultry litter in each HRU within the watershed so that the total cost of meeting specific phosphorus emission targets is minimized.

The completed programming model will be used to conduct a series of policy analysis scenarios. The proposed research will provide spatially optimal, least-cost allocations of management practices between point and non-point sources to reduce phosphorus runoff in the watershed. Second, it will provide recommendations on management practices each producer should adopt. Integrating these approaches will provide a more complete measure of the value of using new technologies with a market-oriented incentive for producers to reduce land applications of poultry litter.

Policy makers who are searching for solutions to water quality problems will receive better information about the costs of achieving specified levels of phosphorus runoff and about the potential to reduce those costs using alternative technologies. The modeling framework used in this study is extendable to any watershed, and can be used for the modeling of nitrogen runoff, phosphorus runoff, or both.